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Prevalence Urinary Schistosomiasis in Some Odual Communities in Abua/Odual Local Government Area, Rivers State of Nigeria

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ABSTRACT

Urinary schistosomiasis remains a prevalent concern in certain regions of Nigeria, particularly where populations frequently come into contact with water bodies hosting the snail intermediate host of the parasite. In the Abua communities of Abua/Odual Local Government Area, Rivers State, Nigeria, a study was conducted to assess the prevalence and associated factors of urinary schistosomiasis among school-aged children. Midstream urine specimens were collected from 110 pupils (45 males and 65 females) across five schools (Okana, Omaraka, Amalem, Emilaghan, and Arukwo) and examined using the sedimentation technique. Results indicated an overall prevalence of 43.6%, with varying infection rates across the schools, though statistical analysis revealed no significant difference. Females exhibited a slightly higher infection rate (47.7%) compared to males (37.8%), with no significant disparity noted. Age group analysis revealed the 10-13 age group as most affected (56.3%), followed by the 6-9 age group (36.1%), and the 14 & above age group (30.8%). Risk factor assessment highlighted reliance on borehole water (52.7%) and irregular bathing habits as prominent contributors to transmission. The study underscores the persistent presence of Schistosoma haematobium in the area, particularly affecting children engaging in water-related activities. It advocates for government intervention through health awareness campaigns, provision of clean water sources, and anthelminthic treatment for infected individuals. These measures are crucial in mitigating the burden of urinary schistosomiasis and improving public health outcomes in the affected communities.

INTRODUCTION

Schistosomiasis, also called bilharzia, is a tropical disease of poverty that is widespread in the tropics and subtropics, impacting one billion people, with 250 million infected, in 74 countries (Colley *et al.*, 2014; McManus *et al.*, 2018). The infection is caused by trematode blood flukes of the genus Schistosoma; These flatworms have a complex life cycle that involves, depending on species, aquatic or amphibious snails as intermediate hosts and mammalian definitive hosts. The main clinically important species are as follows: *S. japonicum*, transmitted by the amphibious snail oncomelania and resulting in intestinal and hepatosplenic schistosomiasis in the People's Republic of China, the Philippines and Indonesia; *S. haematobium*, the most common species, transmitted by bulinus snails and causing urogenital schistosomiasis in Africa and in some countries of the Arabian peninsula (it has also recently emerged on the French island of Corsica (Boissier *et al.*, 2016) and *S. mansoni* which is transmitted by biomphalaria snails and causes intestinal and hepatic disease in Africa, the Arabian peninsula and Latin America.

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S. guineensis and *S. intercalatum* (both endemic in Central and West Africa) and *S. mekongi* (restricted to a short stretch of the Mekong River in southern Lao People's Democratic Republic and eastern Cambodia) are of local, and regional importance (Colley *et al.,* 2014; McManus *et al.*, 2018).

Schistosomiasis also known as bilharziasis or snail fever is a parasitic disease that seriously affects internal organs with the popular symptom being blood in urine and/faeces and an enlarged liver. The disease mostly affects the health of school-age children. Schistosomiasis is a chronic and debilitating disease caused by digenetic trematode flatworms (flukes) of the genus Schistosoma. It is one of the most common parasitic infections in the world, ranking second to only malaria in terms of its socioeconomic and public health importance in tropical and subtropical areas. It is also the most prevalent of the waterborne diseases and one of the greatest risks to health in rural areas of developing countries. Globally, an estimated 239 million people are currently infected, with a burden estimated at more than 3.5 million disability-adjusted life years (DALYs) (Hotez, 2014; Global Health Estimates, 2015).

In many endemic areas, severely infected individuals may suffer fibrosis of the bladder, kidney damage, bladder cancer, and death if untreated. This, however, depends on several factors such as host-parasite genetics, degree and length of exposure, intensity of infection, host immune response to the parasites, and coinfections with other tropical diseases such as malaria and HIV-1 (Mazigo *et al.,* 2012).

Schistosoma species, the causative agent, has a complex life cycle, which alternates with humans, and in an intermediate host of a freshwater snail. Schistosoma needs the right conditions to complete its life cycle, including both hosts (humans and snails) and freshwater. Humans become infected when they come into contact with the infective stage of the life cycle (the cercaria) in water, where the snail hosts are found. Eggs are passed out with the urine. If this is in water (e.g. a pond or lake) the eggs will hatch into miracidia. The miracidia enter a freshwater snail (*Bulinus* specimen). In the snail, the larvae go through further stages of development and multiplication. The next stage of the schistosome development is cercaria, which is released from the snail. If these come into contact with humans, e.g. when they are swimming, bathing, or wading in the water, the cercariae can enter unbroken skin – often of the feet or ankles (shedding their tail as they do so). Once inside a person, the larvae migrate through the blood system to the liver. In the veins of the liver, the schistosomes undergo further development and mature into adults. The adults leave the blood system of the liver to migrate again, finally ending up in blood vessels around the urinary bladder (and less often, other organs). Here eggs are released against the bladder wall. These eggs then penetrate into the inside of the bladder, where they are passed out with the urine to begin the cycle again. When infected people urinate in a community water source, the eggs are immediately released. The eggs hatch and infect freshwater snails, such as the Bulinus, which then become the intermediate hosts. Inside the snails, the parasites develop and multiply; they are now able to re-enter the skin, infecting new victims and continuing the cycle.

Symptoms associated with urinary schistosomiasis are caused by the eggs that remain trapped in body tissues. In the case of urinary schistosomiasis, the trapped eggs tear and scar the tissues of the bladder, ureters, and kidneys. Bladder cancer is common in advanced cases of the disease. Death resulting from the disease is mostly due to bladder cancer associated with urinary schistosomiasis (The Carter Center, 2010).

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This is a human disease condition, which is caused by infection of the trematode *Schistosoma heamatobium*. The parasite is found in the venous plexus draining the urinary bladder of humans. During infection, the parasites deposit terminal-spine eggs which clog the venous plexus, impeding blood flow. This bursts the veins, allowing blood and eggs to enter the urinary bladder, resulting in the characteristic symptom of blood in urine which is known as haematuria (Ekpo *et al.*, 2010).

In sub-Saharan Africa alone it is estimated that 70 million individuals experience heamaturia, 32 million with difficulty in urinating (dysuria), 18 million with bladder-wall pathology, and 10 million with major hydronephrosis from infection caused by *Schistosoma haematobium*. The mortality rate due to nonfunctioning kidneys (from *S. haematobium*) and haematemesis has been put at 150,000 per year. The above figures imply that urinary schistosomiasis is an important public health problem in sub-Saharan Africa and second to malaria in morbidity. Urinary schistosomiasis is a parasitic infection that causes serious inflammatory changes and continues to damage different organs of the body. The infection is acquired through contact with cercaria-polluted water during washing clothes and utensils, swimming, wading, or bathing. More than 66 million people throughout 54 countries in Africa are affected by *S. haematobium* infection (Akinboye *et al.*, 2011).

In *S. haematobium* infection, the eggs are trapped in tissues and cause progressive damage to the bladder, ureters and kidney. There is dysuria (painful urination) and haematuria (blood in urine) (Bello *et al.*, 2014). In a study conducted in Nigeria, 26% of more than 1000 cases of appendicitis were attributed to *S. haematobium* (Carter Center, 2015).

In Nigeria, urinary schistosomiasis is a serious health problem with about 29 million infected cases and 101 million people at risk of infection (Hotez *et al.,* 2012; WHO, 2013; WHO, 2016). Recent reports showed an unabated increase in infection in all the geographical zones of the country, particularly among schoolchildren (Singh *et al.,* 2016; Abdulkadir *et al.,* 2017). Epidemiological studies in many endemic communities have attributed sustained infection to many factors including routine agricultural practices, human behavior, and failed water projects to meet the needs of people (Singh *et al.,* 2016).

There are about 350 species of freshwater snails that are known to be medically or veterinary important (Hailegebriel *et al.,* 2020). Among these diverse snails, *Biomphalaria, Bulinus,* and *Oncomelania* snails (Inobaya *et al.*, 2014) are the dominant snail genera that are involved in the transmission of human schistosomiasis. Biomphalaria genus consists of *B. pfeifferi, B. glabrata, B. sudanica, B. straminea, B. tenagophila, B. alexandarina*, and *B. choanomphala* (Hailegebriel *et al.*, 2020).

Bulinus consists of 37 recognized species, which is grouped mainly into four, namely, *Bulinus africanus, B. forskalii, B. truncates/tropicus,* and *B. reticulatus* (Kane *et al.,* 2008; Hailegebriel *et al.,* 2020). *Bulinus* snails serve as intermediate hosts for *S. haematobium*, which is responsible for urinary schistosomiasis.

The study aimed to investigate the current status of urinary schistosomiasis in some Odual communities where intervention and prevention by the government and NGOs over the years.

MATERIALS AND METHODS

Description of the Study Area:

This study was conducted in five primary schools in Abua/Odual Local Government Area. The geographical coordinates of Abua/Odual are 4.8207^{o} N, 6.5356^{o} E. The Local Government Area has an area of 704 km^{2} and a population of 282,410 (National Bureau of Statistics, 2010). The study area experiences periodic flooding and high rainfalls between March and October each year and is naturally endowed with tropical rainforests and many mangrove swamps. The people of Abua/Odual are mostly engaged in farming, fishing and hunting since they are surrounded by water. However, with the advent of civilization, most of the inhabitants of the area have now delved into other contemporary businesses and some others have become self-employed. Most of the farmers are still seen walking to their farmlands on near barefoot and sometimes completely barefooted with their children.

Study Design:

A cross-sectional study was conducted, and midstream urine samples were collected from students in the five under-listed primary schools in the study area as follows: State Primary Schools (SPSs) Okana, Amalem, Omaraka, Emilaghan and Arukwo, and the specific focus was collection of urine samples and snail intermediate host from the study area.

Collection of Urine Specimen:

The midstream urine specimen was collected from a total of 110 pupils (an average of 22 from each school) between the hours of 09:00 am and 11:00 am each collection day and was comprised of 45 males and 65 females. Each pupil was given a clean, dry, sterile, transparent, universal, plastic sample bottle to urinate in with emphasis on the last drop. The urine specimens in the universal bottles were collected from the students, properly designated, and transported to the biology research laboratory at Ignatius Ajuru University of Education Rumuolumeni Port Harcourt for parasitological analysis. The collection of the urine specimen was done over a period of 11 weeks from the month of November 2023 to January 2024.

Prevalence Status of The Population:

The midstream urine specimens were collected from all the sampled pupils and analyzed for the presence of the eggs of the schistosome parasite using the sedimentation method as described by Cheesbrough (2009). With the use of a 3ml plastic pipette, 9 ml of each urine sample was collected from the universal bottles and introduced into a plastic test tube and was placed in a centrifuge machine and centrifuged at 2500 revolutions per minute (rpm) for 5 minutes, the supernatant was decanted, and the sediment viewed under the binocular light microscope using the x4, x10 and x40 objective lenses for the presence of terminal spine ova of *Schistosoma haematobium*. Eggs of *Schistosoma haematobium* were counted under the light microscope at low magnification. The results obtained were expressed as the number of *Schistosoma haematobium* eggs/9ml of urine samples examined. The number of all parasites found on each sample was recorded and the overall prevalence was calculated as follows:

$$\text{Prevalence } = \frac{\text{No. of samples positive}}{\text{Total no. of samples examined}} x100$$

Establishment of School-Related Prevalence of Urinary Schistosomiasis:

To achieve this objective, varying numbers of urine samples ranging from 17 – 28 were collected from each of the 5 primary schools, thereby giving a total of 110 specimens from the schools in the study area. They were properly examined as described in this study. The number of urine specimens positive for *Schistosoma haematobium* parasite was divided by the total number of students (samples) examined and multiplied by 100 in order to establish the school-related percentage prevalence.

Evaluation of Occurrence of Infection in Relation to Sex of The Children:

To achieve this objective, urine specimens were collected from both male and female students and examined as earlier described in the study. The number of urine samples positive for *Schistosoma haematobium* was divided by the total number of pupils (specimen) in each sex and multiplied by 100 in order to establish the infection rate among both sexes.

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Assessment of Infection in Relation to Age of The Pupils:

To achieve this objective, urine samples were collected from pupils of all ages in the schools and their ages were divided into the following four age brackets: 6-9, 10-13, and 14 & above and examined: The number of urine samples positive for *Schistosoma haematobium* was divided by the total number of pupils (samples) in the particular age group and multiplied by 100 in order to access the infection rate.

Identification of the Schistosome Parasite:

Identification of the parasite from the samples was done using the morphology of the organism in Atlas of Medical Helminthology and Protozoology after Chiodini et al., (2001) and Medical Parasitology by Arora and Arora (2010).

Data Analysis:

Data generated from this study was analysed using simple percentages and summarized into tables and pie charts. Also, Chi-square (χ^2) statistics in the Statistical Package for Social Sciences (SPSS) version 23.0 was used to test the relationship between variables and a p-value less than 0.05 was considered significant.

RESULTS

The result obtained from this study revealed that out of the total of 110 midstream urine samples collected from pupils of both sexes and from the five schools in the study area and examined, overall, 48(43.6%) of the specimens were found with *Schistosoma haematobium* the causative parasite of urinary schistosomiasis, while 62 representing 56.4% of the urine samples where not found to habour any *Schistosoma haematobium* parasite (Fig. 1.).

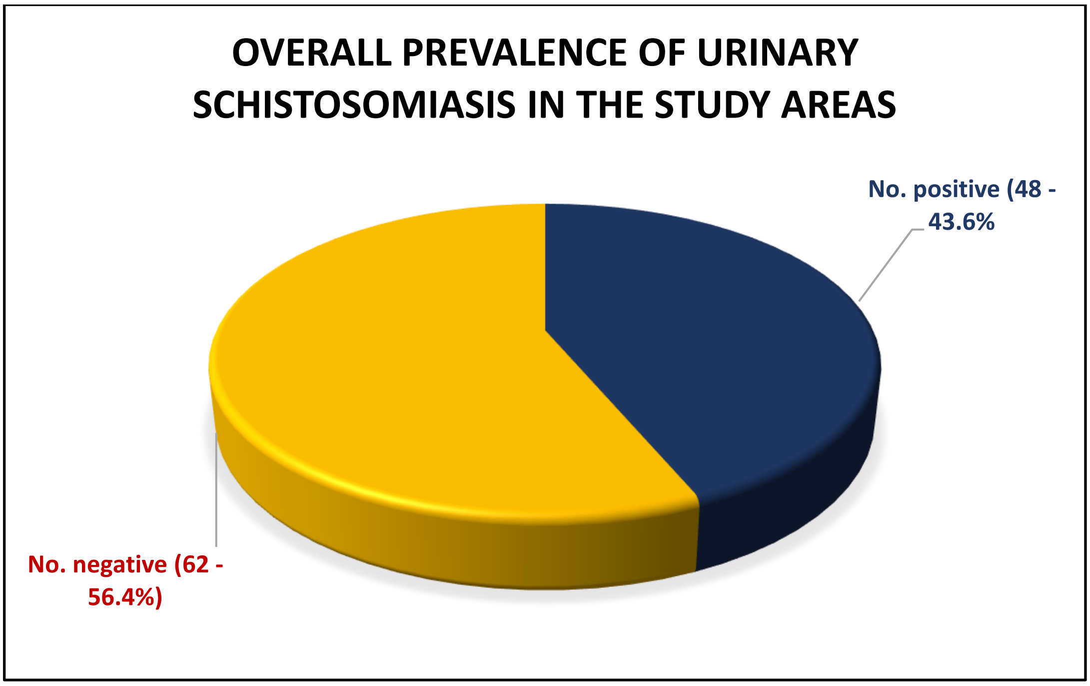

Fig. 1: Overall prevalence of urinary schistosomiasis in the study areas.

School/Community-Related Prevalence:

Five primary schools were sampled from the study area in this study. The outcome of the examination of the urine samples from these schools is reported as follows: from SPS Okana, 28 pupils were examined out of which 15 representing 53.6% from the school were found to habour *Schistosoma haematobium* eggs. From SPS Omaraka 22 pupils were examined out of which 9 pupils representing 40.9% of the samples from this school were found with *Schistosoma haematobium* eggs. From SPS Amalem, urine samples were collected from 18 pupils out of which 6(33.3%) were found with *Schistosoma haematobium* eggs. SPS Emilaghan, a total of 13 pupils representing 33.3% of subjects from this school were found with *Schistosoma haematobium* eggs. Finally, from SPS Arukwo out of the 17 pupils examined from this primary school, *Schistosoma haematobium* eggs were encountered in 5 representing 29.4% of the samples examined. Chi-square statistics showed that there was no significant difference between the primary schools examined and *Schistosoma haematobium* parasite infection (p=0.395) (Table 1).

Table 1. Prevalence of urinary schistosomiasis in relation to school/community (n=110)

School/community	No. examined	No. positive (%)	No. negative (%)
SPS Okana	28	15 (53.6)	13 (46.4)
SPS Omaraka	22	9 (40.9)	13 (59.1)
SPS Amalem	18	6 (33.3)	12 (66.7)
SPS Emilaghan	25	13 (52)	12 (48)
SPS Arukwo	17	5 (29.4)	12 (70.6)
Total	110	48 (43.6)	62 (56.4)

Legend: Chi-square (X^2)= 4.076 d.f= 4 p= 0.395 (Statistically not significant)

Sex-Related Prevalence:

For the sex-related prevalence, 45 male and 65 female pupils were examined in the study. *Schistosoma haematobium* eggs were encountered in 37.8 % of the male samples, representing (17/45) of the samples, while 47.7% of the female samples representing (31/65) were found with *Schistosoma haematobium* eggs. This makes the female pupils the most infected in the study. Chi-square statistics show that there was no significant difference between the sex of pupils studied and *Schistosoma haematobium* parasite infection (p=0.302) (Table 2.).

Table 2: Status of urinary schistosomiasis in relation to sex of pupils (n=110).

Sex	No. examined	No. positive (%)	No, negative (%)
Male	45	17 (37.8)	28 (62.2)
Female	65	31 (47.7)	34 (52.3)
Total	110	48 43.6)	62 (56.4

Legend: Chi-square (X^2)= 1.062 d.f= 1 p= 0.302 (Statistically not significant)

Age-Related Prevalence:

Three age groups were created from the data generated from the sampled pupils and further used for the analysis of the study. The age groups, the number examined, the number positive from each age group and their corresponding percentage prevalence are recorded as follows: in the 6-9 years age group, 36 pupils were found in this group out of which 13(36.1%) were found positive for *Schistosoma haematobium*; in the 10-13 years age group, 48 pupils were found this age group out of which 27(56.3%) were found to habour *Schistosoma haematobium*; finally, in the 14 and above age group, only 26 pupils were encountered in this age group out of which only 8(30.8%) were seen with *Schistosoma haematobium* parasite. This makes the 10-13 years age group the most infected age group with the 14 years and above age group the least parasitized in the study. Chi-square statistics show that there was no significant difference between the age group of students and *Schistosoma haematobium* parasite infection (p>0.05) (Table 3.).

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Table 3: Occurrence of Schistosoma eggs in relation to the age group of students (n=110**).**

Age group (yrs.)	No. examined	No. positive	% pos.	No. negative	% neg.
6 – 9	36	13	36.1	23	63.9
10 – 13	48	27	56.3	21	43.7
14 & above	26	8	30.8	18	69.2
Total	110	48	43.6	62	56.4

Legend: Chi-square (X^2)= 5.684 d.f= 2 p= 0.058 (statistically not significant)
Key: No.= Number, Yrs.= Years, pos.=positive, neg.= negative, %=percentage

Risk Factors Associated with Transmission of Urinary Schistosomiasis in The Study Area:

The risk factor assessment for the transmission of urinary schistosomiasis in the study areas is presented as gathered from the responses provided in the questionnaires as follows: for the source of drinking water: 52.7% drink from boreholes (tap), 21.8% drink from the stream, 11.8% drink from wells, 1.8% drink from the mono pump, 1.8% drink from rain, while 10% of the sampled drink from sachet water; furthermore 25.5% bath regularly in the river/stream, 20% do not, while 54.5% of the respondents bath sometimes; again 16.4% of the respondents boil their waters before drinking, 69.1% do not, while 14.5% boil their waters sometimes; finally 47.3% of the respondents wash regularly in the stream/river, 23.6% do not, while 29.1% of the study subjects wash sometimes in the stream/river (Table 4.).

Table 4: Risk factor assessment for urinary schistosomiasis in the study area (n=110).

Variable	Frequency (%)
What is your source of drinking water?	
Borehole (tap)	58 (52.7)
Stream	24 (21.8)
Well	13 (11.8)
Mono pump	2 (1.8)
Rain	2 (1.8)
Sachet	11 (10)
Do you bathe in the stream/river regularly?	
Yes	28 (25.5)
No	22 (20)
Sometimes	60 (54.5)
Do you boil your water before drinking?	
Yes	18 (16.4)
No	76 (69.1)
Sometimes	16 (14.5)
Do you wash in the river/stream regularly?	
Yes	52 (47.3)
No	26 (23.6)
Sometimes	32 (29.1)

Key: n= sample size, %= percentage

DISCUSSION

The study unveiled an overall prevalence rate of 43.6% for Schistosoma haematobium, with 48 cases detected among the 110 midstream urine samples collected from both sexes across five schools. This figure bears resemblance to the 45.6% overall prevalence reported by

Abdulkareem *et al.* (2018) in their investigation of urogenital schistosomiasis among schoolchildren within selected rural communities of Kwara State, Nigeria. Notably, it surpasses the findings of Mngomezulu et al. (2002) in South Africa, who recorded a prevalence of 35.1% among primary school children. Furthermore, it exceeds the prevalence rate of 13.8% (57 out of 413) reported by Akinneye *et al.* (2018) in their examination of urinary schistosomiasis prevalence among Secondary School Students in Ifedore Local Government, Ondo State, Nigeria. Conversely, it falls short of the prevalence documented by Bala *et al.* (2012), who reported an overall prevalence of 74.0% (296 out of 400) and a mean intensity of 77.63 eggs per 10ml of urine in their preliminary investigation conducted in Abarma village, Gusau, Nigeria.

Further insights from retrospective studies indicate an overall prevalence of 48% (192 out of 400) and a mean egg intensity of 12.02 eggs per 10ml of urine, as reported by Muhammad *et al.* (2019) in their study titled "Prevalence of Urinary Schistosomiasis Among Primary School Pupils in Wamakko Local Government, Sokoto State, Nigeria. The observed disparities in prevalence levels may be attributed to variations in sample size, geographical location, intensity of water-related activities among subjects, timing of the study, and the methodologies employed for analysis.

Regarding the examination of urine specimens from each of the five schools, notable findings emerged. Among the schools examined, SPS Okana exhibited a 53.6% prevalence rate, with 15 out of 28 pupils found to harbor Schistosoma haematobium eggs. Similarly, SPS Omaraka, SPS Amalem, SPS Emilaghan, and SPS Arukwo displayed prevalence rates of 40.9%, 33.3%, 33.3%, and 29.4% respectively. However, statistical analysis via chi-square tests revealed no significant difference between the primary schools examined and Schistosoma haematobium parasite infection. The variation in infection rates is largely attributable to differences in sampling sizes, reflective of the pupil populations within each school at the time of sampling.

Furthermore, an examination of gender-based infection rates revealed a higher prevalence among female subjects (47.7%) compared to males (37.8%). However, statistical analysis did not indicate a significant difference between the sexes and Schistosoma haematobium parasite infection. This finding contrasts with previous reports, such as those by Akinneye *et al.* (2018) in Ondo State, Nigeria, and Bala *et al.* (2012) in Gusau, Nigeria, which documented varying prevalence rates between genders.

Analysis by age groups revealed distinct prevalence rates, with the 10-13 years age group exhibiting the highest prevalence (56.3%) and the 14 years and above age group displaying the lowest (30.8%). However, chi-square tests indicated no significant difference between age groups and Schistosoma haematobium parasite infection. This finding aligns with the observations of Abdulkareem *et al.* (2018) in Kwara State, Nigeria, who similarly noted a higher prevalence among specific age groups.

Risk factor assessment highlighted significant contributors to urinary schistosomiasis transmission in the study areas. Predominantly, the utilization of boreholes (tap) for drinking (52.7%), bathing in rivers/streams (25.5%), and infrequent water boiling practices (69.1%) emerged as key factors contributing to the endemicity of urinary schistosomiasis in the study area. These findings underscore the necessity for targeted intervention strategies to mitigate transmission and reduce the burden of the disease within these communities.

Conclusion

The findings of this study underscore the endemic nature of urinary schistosomiasis within the study area, with an observed infection rate of 43.6%.

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Notably, pupils across all primary schools sampled within the respective communities exhibited varying levels of infection. Furthermore, the study revealed a higher prevalence of infection among female pupils compared to their male counterparts, while the 10-13 age group demonstrated the highest incidence of Schistosoma haematobium infection.

Analysis of risk factors highlighted significant contributors to the transmission of urinary schistosomiasis in the study areas. Predominantly, a substantial proportion of respondents reported drinking borehole water, followed by those consuming water from streams/rivers. Additionally, a considerable number of respondents admitted to occasionally bathing in rivers/streams, while a significant proportion did not engage in water boiling practices before consumption. Moreover, a noteworthy proportion of respondents reported regular washing activities in the stream/river, further indicating potential exposure to the parasite.

Lastly, the study confirmed the presence of the snail intermediate host of the Schistosoma parasite in rivers/streams within the study areas, further substantiating the conducive environment for transmission. These findings collectively emphasize the urgent need for targeted interventions aimed at mitigating transmission pathways and reducing the burden of urinary schistosomiasis within these communities. Efforts focused on improving access to safe drinking water sources, promoting hygiene practices, and implementing snail control measures are imperative to effectively combat the spread of the disease and safeguard the health of the population.

Recommendation:

Based on the findings of this study, several recommendations are proposed to address the high prevalence of urinary schistosomiasis in the study area:

1. Provision of Pipe-Borne Water: The government should prioritize the provision of pipe-borne water to rural areas, including the communities within the study area. Access to safe and clean drinking water is essential to reduce reliance on potentially contaminated water sources such as streams and rivers, thereby diminishing the risk of schistosomiasis transmission.
2. Health Education Initiatives: The Schistosomiasis Control Programme should implement comprehensive health education campaigns aimed at raising awareness about the life cycle of the parasite and the importance of consistent environmental sanitation practices. Educating individuals within the study area about the modes of transmission, preventive measures, and the significance of personal hygiene can empower communities to take proactive steps in preventing infection and reducing disease burden.
3. Strengthening Healthcare Infrastructure: Health centers and hospitals in the communities should be equipped with adequate medical personnel, diagnostic facilities, and essential medications for the diagnosis and treatment of urinary schistosomiasis. Ensuring access to free and sustainable diagnosis and treatment services is crucial for effectively managing the disease and improving health outcomes among affected individuals.

By implementing these recommendations, stakeholders can work towards reducing the prevalence of urinary schistosomiasis, enhancing community health, and mitigating the socioeconomic impact of the disease in the study area. These interventions underscore the importance of a multisectoral approach involving government agencies, healthcare providers, community leaders, and individuals in combating schistosomiasis and promoting public health

Declarations:

Ethical Consideration: The ethical clearance for this research was obtained from the director, directorate of research and development, Ignatius Ajuru University of Education Rumuolumeni, Port Harcourt. Also, approval was obtained from the Abua/Odual Local Government Education Authority, signed by Ven. Okpara David – supervising director Abua/Odual L.G.A. Also, approval was obtained from the head teachers of the five schools under study: This was followed by official visits to the management of the schools, giving detailed explanation of the essence of the research. Furthermore, interactions were made with the pupils at the assembly ground during which proper orientation was given to the pupils about the research work.

Competing interests: Not applicable

Author's Contributions: Not applicable the main author did the entire work

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Availability of Data and Materials: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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